

THE INSECTS OF THE EVENING PRIMROSES IN NEW JERSEY.

BY EDGAR L. DICKERSON AND HARRY B. WEISS,

NEW BRUNSWICK, N. J.

The observations recorded in this paper were made in various parts of New Jersey on the evening primroses which are commonly and as will be shown later incorrectly known as *Cenothera biennis* L., and probably such additional species as *oakesiana* and *cleistantha*. Most of the work was done during the season of 1919 and it might be added that it was carried on incidental to regular duties of an inspection nature.

Cenothera, according to Bailey's Standard Cyclopaedia of Horticulture is said to be Greek for wine-scenting in allusion to an ancient use of the roots. The *cenotheras* are mostly dry soil plants and are chiefly North American. In a letter Dr. George H. Shull writes as follows: "The true *Cenothera biennis* L. has not been found in America but is very widely distributed in Europe. It is generally understood of course that all of the *cenotheras* are of American origin but that this particular species has no known native American habitat, which probably means, merely that the American *cenotheras* are still only very imperfectly known. The number of species occurring in America and formerly included under the name *biennis* in the manuals is very large. I have not the least doubt that when the *Cenothera* species of the eastern United States are fully known taxonomically, there will be hundreds of them."

In this paper, therefore, the term evening primrose should be taken to mean in the main, those species commonly known and grouped together under the name *biennis*. These species are mostly biennial and make only a rosette of leaves during the first year. According to Stone (Plants of Southern New Jersey, N. J. St. Mus. Rept., 1910) dry, open ground is preferred. They are common in the northern, middle and coast districts south to Cape May, being largely weeds in waste places and cultivated ground. In this character they are occasionally found in the pine barrens. Flowers occur from late June into October and fruits from late July through autumn.

Before taking up the accounts of the insects associated with the evening primroses, it will not be out of place to call attention to a paper by Alice Adelaide Knox on "The Relation of Injury to Fasciation in the Evening Primroses," which appeared in *The Plant World* (Vol. 10, No. 7, July, 1907). Parts of this paper are quoted below.

"Examination of species of *Oenothera* by cutting or splitting the axes, reveals within many of them comparatively large numbers of the larvæ of a small moth named *Mompha*, which subsist on the pith toward the end of summer, and winter in the hollow stem. Some of the larvæ develop in the ovary and emerge in the winged state from the ripened capsule. Still others hatch in the leafy tip of the flowering stalk or in the rosette, and in the latter bind together the leaves to make a protective covering and feed in its heart during the cold months. In each case the eggs are laid in the growing region, so that the initial meristem is subject to injury from the ovipositor. In the last instance large mutilations may be caused by the devastations of the feeding, and such ravages account for the frequent abortion of the main axis among the fasciated plants. On the other hand many plants remain unaffected, for the new leaves furnish sufficient food, the larva does not penetrate the center of the axis, and never reaches the meristem. In still a third case the meristem may be barely touched or irritated, and the injury may be a one in its effects similar to those caused by the ovipositor. Where the wound is inflicted by the mouth parts of the larva it is ordinarily more easily detected than when made by the ovipositor of the imago, for it frequently interferes with procambial development in such a way that the bundle ring is symmetrical, or there is a conspicuous callus formation, or other signs are evident, by which its course may be traced and its origin ascertained. When the tissues are pierced by the ovipositor the injury is so small that it is impossible to find it after any considerable amount of growth has occurred. A comparatively deep incision measures 1.25 mm. in longitudinal section; it disappears almost immediately upon the consequent enlargement of the surrounding cells, and it is useless to look for traces of it at advanced stages of development. Fasciated tips so young that their flattened character can only be determined microscopically show wounds in the meristem at the apices, but as the banding of the stem becomes conspicuous, all traces of the disturbance are gradually

lost. The time of the attack makes a great difference in the development. If the injury is to a growing region of a biennial plant still in the rosette stage, the plant fasciates during the rosette period, and the growing region becomes linear before the time of the elongation. The stems are then flat from the base. If the plant is adult at the time of the invasion the injuries are in the upper part of the stems which have already completed their first growth. These fasciated stems are round below and flat above. In a given field of plants it will also be noticed that most of the fasciated individuals begin to flatten from the same relative point on the axis. This seems to indicate that the banding is stimulated in all of them at the time of the advent of the new swarm, or its less penetrating mode of attack may account for the absence of any degree of fasciation whatever.

“The importance of conditions of culture correlates well with the above observations and the character of the environment is significant in the production of the fasciation in two ways: namely, in providing a favorable habitat for the insect, and in promoting vigor in the individual plant, such that it will recover from, and not succumb to, the mutilations. Degrees of moisture, isolation, and light all influence the activities of the insect as well as the development of the plant itself. Healthy plants may be more attractive to the insects; damp or rainy weather may drive the insects into the flowering heads, or under the young leaves; isolated plants in full sunlight may be better exposed for the hatching of the eggs. An entomological study of the habits of these animals would be of interest in this connection, and would throw light on the exact relation of the insect's life-history to the life-history of the plant. There always remains the further necessity that the plant shall be ‘susceptible,’ but we are assured by de Vries that the degree of susceptibility of the normal and flourishing primrose is superior to that of the ailing plant, and that the physiological responses of the two are not alike.”

Without attempting to explain the relation of insect injury to fasciation in these plants, we wish to state that the “*Mompha*” referred to by Miss Knox consists of several distinct species, which confine their attacks almost exclusively to certain parts of the plant; also that these insects belong to the Lepidoptera, the members of which do not possess a true ovipositor and that the eggs of these

species are laid as the case may be, on the stem, leaves, and developing tips and buds and not inserted in the tissue. In view of this we do not see how the initial meristem could be injured by the ovipositor. It would be possible, however, for the larva of the species breeding in the tip to injure this tissue by feeding. During the past summer, hundreds of infested plants were examined in various parts of New Jersey and the amount of visible fasciation found was very small. It therefore appears to us as if the primrose insects do not play such an important part in fasciation as Miss Knox's paper would indicate.

The following species of insects were found associated with the primroses during the second year of their growth, or in other words, with the adult plants. As a rule little was found on the rosettes. The tip moth, *Phalonia Cœnotherana*, winters over in the rosette, as will be shown later and it is quite probable that some of the leaf feeders utilize this stage of the plant for food purposes. The rosettes also should afford hibernation quarters for miscellaneous species. Primrose roots were examined and with one exception the results were negative. This exception consisted of aphids which were found on roots at Hightstown, N. J., by Mr. West. Unfortunately no specimens were saved and the identity of the species is unknown to us.

LEPIDOPTERA.

Rhodophora florida Gn.

This prettily colored moth is one of the species intimately associated with the evening primrose, the larva feeding on the unopened buds and to a much lesser extent, the seed capsules and the adults visiting the flowers by night and resting within the partially closed blossoms during the day. It has been considered an apparently rare insect by collectors until the characteristic habits of the larva or adult were known when it became an obviously common species within the limits of its distribution.

The Flowery Primrose Moth was the popular name used by Dr. Asa Fitch (12th Rept. Nox. Ben. Ins. St. N. Y., pp. 900-906) as the title of a paper in which he gives a very complete account of the life-history and habits of the insect. The species was described by Guenée in 1857 (Hist. Nat. Ins. Lep., Vol. VI, p. 71) from a single female taken in New York by Mr. Edward Doubleday while collect-

ing in that state in 1837. Since its original description it has been noted in various lists and papers, notably by Fitch (*loc. cit.*), by Saunders (Can. Ent., Vol. 2, p. 6, 1869) (Can. Ent., Vol. 3, p. 76, 1871), who studied it in Ontario, Canada, and by Smith (Brook. Bul., IV, p. 28, 1881).

The insect is apparently confined to the eastern part of North America ranging from Canada south through the Atlantic States. Saunders records it from Ontario in July. Winn records it from Montreal and other places in Quebec, July, August (Prel. List Ins. Quebec Lep.); Dyar's List gives Atlantic States and Smith (Ins. N. J.) throughout New Jersey, July, August. In the latter state where our own observations have been made, we have collected it in a number of localities from mid July until mid August. We have also collected it in Connecticut and Mr. W. T. Davis records it from Staten Island in July and August.

The larva destroys or injures many blossoms by its characteristic feeding habit of "boring a round hole in the bud" of sufficient size to admit its head which it sinks downward farther and farther, eating through the folded mass of petals, nearly or quite cutting them asunder and severing also the stamens and pistil." Thus when the flower comes to burst forth from its bud at the close of the day, it is but half its normal size and presents a most rueful aspect with the outer end of its petals gnawed and ragged, and all the beauty of their natural appearance destroyed." (Fitch, *l. c.*). Foliage may also be eaten to a slight extent.

The following descriptions of the different stages and life history notes have been taken from the papers already referred to and from our own observations in the field.

Egg.—"Length one fortieth of an inch; width one forty-fifth. Form nearly round, flattened a little at the base, where it is also somewhat contracted in size, and slightly conical above, with numerous raised striæ, about 36 in all, which run into each other before they reach the tip, where they are reduced to less than half the number, and terminate at the base of a small ring which crowns the tip: this ring has a depression in the center, and the space around the cavity is finely punctured. The striæ are irregularly crossed by numerous fine, raised lines, and thus the whole surface is minutely reticulated, but the meshes are irregular in form, with a

slight depression in the center of each. The color of the egg is dull yellowish pink" (Saunders).

Young Larva.—"Length about one fifteenth of an inch, cylindrical. Head large and black, with a few black and brown hairs. Body above of a dull shining yellow, with a wide dorsal band of dull white. On each segment there are from eight to twelve shining black dots, from each of which arises a single black or brown hair. The upper portions of second and terminal segments have each a large patch of black. Under surface similar to the upper, but with fewer dots; feet black; prolegs pale greenish, faintly tipped with brown" (Saunders).

Full-Grown Larva.—"Cylindrical, tapering slightly at each end and one inch in length, when crawling elongating itself to 1.15, and 0.18 thick. It is clothed with fine, shortish, scattered hairs which are placed symmetrically. Its ground color is pale green, of a yellowish or apple green tint when full grown, but usually pea green when it is smaller. Along the middle of its back is a stripe of a deeper grass green color, and a similar one upon each side of the back. These three stripes extend from the neck to the middle of the penultimate segment. Each of the lateral stripes has a dull cherry red spot at its anterior end, placed on each side of the middle of the neck or first ring, and in rare instances the anterior ends of these lateral stripes are of this color for a short distance. Before it is full grown the lateral stripes are sometimes faint or wholly wanting; and low down on each side is an elevated fold of the skin which forms a faint stripe of a paler color than the ground. The head is a third narrower than the neck and is held obliquely downward and forward. It is slightly paler than the body and is clothed with fine erect hairs.

"A variety of the larva occurs, of a dull pale brownish yellow color, with the stripe olive or dull brownish green. In one instance a young larva 0.60 long was observed wholly destitute of the red spots upon the neck" (Fitch).

Adult.—*Rhodophora florida*. This was described by M. A. Guenée (*l. c.*), whose description follows: "32 mm. Ailes supér, ayant la côte et les deux premiers tiers de leur surface d'un rose vif, et le dernier tiers, ainsi que la frange, d'un jaune-ochracé uni; le tout sans taches ni lignes. Ailes infer, blanches teintées d'ochracé. Des-

sous des quatre ailes ochracé, avec la côte rosé, sans autre dessin. Corps ochracé en dessus et rose en dessous.

“Etat de New Yorck. Coll. Dbday. Une female.”

The eggs are laid singly, usually on the outside of the bud midway between the base and the tip, but the location may vary and they may occur on the inner side or elsewhere on the bud, on the outer side of blossoms at base, on upper surface of leaf (none noted on lower surface), on the stem or even on the seed capsules and as many as four have been noted on a single bud. Material collected at Nutley, N. J., on July 23 was examined and the following numbers of eggs and young larvæ were found on various “heads” or short shoots,—4 e., 1 l.; 1 l.; 5 e., 2 l.; 4 e., 1 l.; 2 e.; 2 e., 1 l.; 6 e., 1 l.; 2 e., 3 l.; 1 e., 3 l.; 2 e.; 3 e.; 8 e. These were found for the most part on the buds.

As the adults emerge irregularly during the summer, apparently fresh specimens being found from early July to mid August, eggs will be found during about this same period and in early or mid August, eggs and various stages of larvæ may be found on one plant at the same time. In about three days time the young larvæ emerge from the eggs and begin feeding on the buds. The habit of the larva of making a hole into the inside of the bud has already been referred to. If all of the bud were eaten not many would be needed to bring the larva to maturity, but its tendencies are wasteful and many buds and some seed capsules may be injured before its development has been completed. Resting as it feeds with the exposed portion of its body resting longitudinally on the bud and being somewhat protectively colored, it may be easily overlooked.

About a month is required for the larva to mature and so they may be found on the plants from middle July to late September. When full grown they enter the ground at the base of the plant to remain until the following season. While they feed singly they show little tendency to wander and Dr. Fitch notes that the larvæ will enter the soil of even a hard trodden walk of a garden rather than seek softer soil at a greater distance.

The adults are inactive during the day and are found resting on the flowers within the partially closed petals. From this position one is easily captured and it was in this way that a considerable series of specimens was obtained in various parts of New Jersey.

This moth, like many other species, is attracted to light. The first specimen seen by Dr. Fitch in 1858 was brought to him from Adam, Mass., where it was taken at light and four years later he captured a second specimen at light in his own home in New York state.

We have not bred any specimens and find no record of parasitic enemies in the literature relating to this species. *Triphleps insidiosus*, a common predaceous hemipteron, however, was observed feeding on the egg of this species. The lancets of the beak were inserted in the side of the egg, the tip of the beak scarcely penetrating the covering and in this position it rested for thirty minutes. The egg gradually collapsed on one side and then the base cracked open, the contents having been practically exhausted.

***Desmia funeralis* Hubn.**

This species, known as the grape leaf-folder, has long been recognized as a pest of the vine. It is widely distributed in the United States and probably occurs in nearly every locality where wild or cultivated grapes grow. At first its occurrence on primrose at Princeton Junction, N. J., appeared somewhat unusual, but when it was later found on the same plant at Monmouth Junction and in fairly large numbers at Washington's Crossing, N. J., we concluded that the primrose could be included in its short list of recorded food plants.

In view of the fact that the grape leaf-folder has been known to entomologists in this country since 1855 and has been treated in various publications, it is not necessary to go into details here concerning its life-history and habits. Therefore the following account except where its occurrence is mentioned in connection with evening primrose, has been drawn from what appears to be the latest publication on this insect by J. F. Strauss.¹

It was first noted by us in New Jersey at Princeton Junction on July 2, when small and almost full grown larvæ were taken from the foliage of evening primrose. The young larvæ were found feeding on leaves which had not been folded, while the older ones were always within a folded or rather rolled leaf. The leaves were rolled either from the tip back or lengthwise up or down and the larvæ fed within the cylinder either on the upper or lower epidermis, de-

¹ The Grape Leaf-Folder. Bul. 419, U. S. D. A., Bur. Ent.

pending on the way the leaf was rolled. Sometimes the entire tissue was eaten. Strauss makes no mention of the leaf-rolling habit in connection with its injury to grape foliage in the east, but according to Quayle,² in California the leaf is distinctly rolled and not folded over on the upper surface and fastened down by strands of silk as it is in the east. In addition Quayle states that the free edge is consumed. On primrose in New Jersey both the free edge and the inner surface of the rolled leaf were eaten.

During the first week of July our specimens became full grown and each pupated in a cocoon formed by the cutting of the leaf in two places from the midrib to the edge and the folding of this flap over to the opposite edge of the leaf. About twelve days were required for the pupal stage, the first moths issuing on July 18. According to Strauss, the full-grown first brood larvæ leave their shelters on grape and drop to the ground where they transform among the fallen leaves, trash, etc., and in exceptional cases a larva may web several leaves together and pupate within or it may pupate within the folded leaf where it has fed. The pupæ of the second brood are also found among dead leaves and hibernation takes place in this stage.

Unfortunately the second brood pupæ on primrose were not observed, and it is not known whether a cocoon is made or not. A second brood undoubtedly occurs in New Jersey because adults were found during the middle of July and larvæ during August. From the foregoing it is apparent that the habits of the larvæ vary considerably within certain limits. In addition to wild and cultivated grapes, other recorded food plants are Virginia creeper and redbud. The following brief descriptions are adapted from Strauss.

Egg.—Length 0.7 mm., elliptical, membranous chorion presenting under high magnification, delicate, hexagonal markings.

Full Grown Larva.—Length about 1 inch; widest in middle and tapering toward either end; glossy, translucent yellow green on sides and somewhat darker above, with scattered, fine, yellow hairs on each segment; the head and prothoracic shield are light brown and there are light brown spots on the sides of the first two thoracic segments.

² Quayle, H. J., Bul. 192, Cal. Agric. Exp. Sta.

*Adult.—Desmia funeralis.**Pyralis funeralis* Hubn., *Pyr. f.*, 103, 1796.*Anania funeralis* Hubn., *Verz. Schm.*, 360, 3449.*Botys bicolor* ? Swain., *Zoöl. Illustr.*, II, pl. 77, 1821-2.*Desmia maculatis* Westw., *Mag. Zoöl. Class.*, IX, pl. 2, 1832.*Desmia funeralis* (Hubn.) Guen., *Delt. et Pyral.*, No. 124, p. 190, 1854.

Expanded the wings of the moth measure about nine tenths of an inch. They are very dark brown with an opalescent or silvery reflection and border with white. In both sexes the forewings have two nearly oval, white spots. The hind wings of the male bear one spot, which may be divided in the female. The body is black crossed by two white bands in the female and by one band in the male.

Strauss reared seven species of hymenopterous and three species of dipterous parasites from the larvæ and pupæ of *Desmia funeralis* and an account of these together with a bibliography of 26 titles can be found in his publication.

Celerio lineata Fabr.

This well-known species is known to feed on purslane, buckwheat, turnip, watermelon, chickweed, dock, apple, currant, grape, gooseberry and evening primrose according to Beutenmüller (*Amer. Mus. Nat. His. Guide Leaflet No. 10, 1903*) and is recorded by Smith (*Ins. N. J., N. J. St. Mus. Rept.*, 1909) as being common throughout New Jersey, July to November.

During the summer of 1919 it was abundant at Princeton on evening primrose being grown for experimental purposes, but appeared to be rare on this plant in other parts of the state. During the 1918 season, it was found on primrose at Nutley, N. J. According to Mary C. Dickerson (*Moths and Butterflies, 1901*) the caterpillars are three inches long and vary greatly in coloring and markings. There appears to be two kinds, one being yellowish green with a series of connected spots along each side of the back, each spot being colored crimson, yellow and black, the other being black with a yellow line down the middle of the back and yellow spots of various sizes along the sides. These two styles may vary in many ways. Pupation takes place in the soil, this stage hibernating.

The moth is a beautiful one, known as the White Lined Sphinx. Two broods occur, the first appearing during June and July and the second during the latter part of August and early in September.

Apantesis arge Dru.

Forbes (23d Rept. St. Ent. Ill., 1905, p. 75) states that this is especially a southern species reported many years ago as destructive to Indian corn in the southern states. In addition to corn it is known to feed upon plantain, smartweed, dock, cactus, lamb's quarters and evening primrose. According to Forbes the species is double brooded, passing the winter in the latitude of Illinois as a partly grown larva and changing to a pupa in March and April of the following year. After a pupal period of 15 days the moths emerge and lay eggs until late in May. These hatch in 15 days, producing a second brood of caterpillars in the middle of June and the pupæ from these are formed early in July. Late in July and early in August the moths appear after a 20-day pupal period and deposit eggs which in September produce the hibernating brood of caterpillars.

Smith (Insects of New Jersey, N. J. St. Mus. Rept., 1909) records it from Sussex to Cape May counties, reporting that Mr. Grossbeck found eggs at Paterson May 5, larvæ from May 18 to June 20, feeding on grass, plantain, *Chenopodium*, *Polygonum* and other low plants. Edwards (Bul. 35, U. S. Nat. Mus.) gives numerous references to this species and lists *O. biennis* as the food plant.

Euthisanotia unio Hubn.

This species, known as the Pearl Wood-nymph, is also recorded as a feeder on evening primrose and grape, although Saunders (Insects Injurious to Fruits, p. 261) states that the larva of this species closely resembles that of *Euthisanotia grata*, long known as a grape feeder, and that Dr. Fitch, who first announced grape as a food plant of *E. unio*, may have mistaken the larva of *grata* for *unio*. Smith (Insects of New Jersey) states that *E. unio* occurs throughout the state, locally, more or less abundant, June and July, the larvæ being found on evening primrose and *Epilobium*. Beutenmuller (Annals N. Y. Acad. Sci., V, March, 1890) furnished these food plants for Smith's List. Edwards (Bul. 35, U. S. Nat. Mus.) gives numerous references to this species and mentions *vitis* as the food plant.

Phalonia œnotherana Riley.

This gayly colored member of the Tortricidæ was described by Riley in 1881 (Tr. St. Louis Acad. Sci., IV, 316) from four specimens bred from *Ænothera* in Missouri by Miss Murtfeldt. Smith (Ins. N. J.) lists it from Essex County, VII, 25 (Kf.), and Clementon, IV, 30 (Haim.), together with the statement, "larva on evening primrose." In addition to these localities we have found it at Woodbury, Highland Park, Hackensack, Riverton, Monmouth Junction, West End and Asbury Park. The larva lives in the tender, developing, leafy tip of the stalk, pulling the small leaves together more or less.

Egg.—Not observed.

Full Grown Larva.—Length 6.8 mm. Width 1.7 mm. Light tawny yellow, not elongate, comparatively broad; surface finely shagreened; divisions between segments and transverse lines on dorsal surfaces of segments usually strongly impressed; each body segment bearing several, comparatively long hairs, with dark or light tuberculate bases; head similar in color to body except spot around which ocelli are clustered and apical portion which are darker (in some specimens entire head is dark brown); thoracic and anal plates brownish or light; each leg bearing several minute hairs.

Pupa.—Length 5.5 mm. Width 1.6 mm. Elliptical, chestnut brown.

Adult.—*Phalonia œnotherana*. The following is the original description by Riley: "Male and female. Expanse 9–10 mm. Basal half of primaries yellow, apical half rose-red. Head gray. Thorax yellow, the patagia tipped with gray: primaries with the basal half yellow, the costa and apical half rose-red, the yellow extending as a broad median emargination into the red; the red portion more or less dotted or fasciate with black shining scales, these scales not encroaching upon a central patch which contains a yellow spot of variable size; some abbreviated black and white costal streaks; posterior margin and fringes yellow, becoming gray at the anal angle; secondaries and under surfaces fuscous; legs silvery, the tibiæ and tarsi mostly black or fuscous. Abdomen silvery-fuscous, paler beneath; ovipositor laterally compressed."

This species appears early in the season and evidently deposits eggs on the developing terminal leaves or heads. The larvæ eat out

a central cavity and pull the small leaves together. When full grown, about the last week in June, each constructs a rather dense, whitish cocoon and anchors it to a partly folded over section of a leaf, usually near the tip. Moths emerge during the last of June and first part of July and full-grown larvæ are again in evidence during the last half of August.

About September 15 moths again appear and probably deposit eggs on the tips of the rosettes as Mr. West discovered at Hackensack, N. J., on November 5, very small, half-grown and several full-grown larvæ at the bases of the young leaves in the centers of large rosettes. These leaves showed evidence of feeding and some of the larvæ had webbed up the tender foliage somewhat. Others were encased in loosely spun cocoons in the fold of a leaf. It is thus evident that overwintering takes place in the partly to full grown larval stages in the rosette.

On June 20 at Riverton, N. J., *Cremastus epagoges* Cush. (identified by R. A. Cushman) was bred from the larva and on July 10 at the same locality *Actia pilipennis* Fall. (identified by J. M. Aldrich). At Red Bank, N. J., August 8, *Tachniphyto cœnea* Coq. (det. J. M. Aldrich) was bred from the larva.

Mompha eloisella Clem.

This is a common and widespread species which was described by Clemens in 1860 (Proc. Acad. Nat. Sci. Phil., 171, 1860). Winn (Lep. Quebec) lists it from Montreal VI (W.) and Rosemere VI (W:) in the pith of evening primrose. Smith (Insects of New Jersey) records it as occurring throughout New Jersey, the larva in the stalks of evening primrose throughout the winter and states that pupation takes place in late May, the adults issuing in June.

This is the most abundant of all the species of *Mompha* associated with the evening primrose and occurs at practically every place in New Jersey where its food plant grows. The larvæ develop in the stems and overwinter in the dried stalks.

Egg.—Length, 0.41 mm. Width 0.27 mm. Oval, translucent, chorion with interrupted, somewhat irregular, longitudinal ridges.

Full Grown Larva.—Length 13 mm. Width 0.17 mm. Yellowish white; elongate; segmentation distinct; constriction between segments prominent; head light reddish brown, irregularly mottled;

each body segment bearing a few minute, fine hairs, the dorsal ones being equidistant, more prominent and forming a transverse row; hairs more numerous on anal segment, head and legs; hooks of anal prolegs forming an apparently continuous, straight or slightly curved line.

Pupa.—Length 5.8 mm. Width 1.5 mm. Reddish-brown; seventh abdominal segment tuberculate laterally; last abdominal segment terminating in two dorsally pointed tubercles, each of which bears a posteriorly pointed, smaller tubercle below it; each abdominal segment bears a couple of hairs on the side.

Adult.—*Mompha cloisella*. In Dyar's Catalogue, the following synonyms are noted: *magnatella* Zeller, *anotheracella* Chambers, and *lyonetiella* Chambers. Clemens's description of this species follows: "Head, face and thorax silvery white, the latter spotted with blackish. Labial palpi white with a dark brown spot on the middle of second joint and two dark brown rings on the third one at the base and one at tip. Antennæ tawny yellow, white at base. Forewings silvery white with a small tuft of tawny scales at the basal joint of the third fold and a larger patch of the same hue on the inner margin at the end of and above the fold. Between the tufts in an oblique dark brown costal streak nearly joined at an angle by another of the same hue in the middle of the wing and exterior to the first tuft is a blackish brown streak which becomes diffuse behind the above while the apical portion of the costa midway between these latter is a rather faint dark spot. Cilia yellowish gray. Hind wings tawny grayish, cilia ochreous."

As has been stated, this species overwinters in the larval stage in cells in the stalks of evening primrose. Most of these cells are found in the main stem, but the side shoots which arise near the ground are often infested. The lateral shoots near the top or middle of the stem are evidently too small to afford suitable quarters. These cells occur in all parts of the main stem except the extreme tip and in most cases except the lower portion. The first twelve inches of stem above the ground and in some cases more is very often taken up with the channels, excrement, etc., of *Tyloclerma foveolatum*, which bred there during the summer and as a rule *cloisella* cells are scarce in this section.

The cells may be close together in a stem or far apart and the

number ranges from one or two to as many as thirty or more. Sometimes the entire pith of the stem is taken up by them and each cell contains a larva. Only in rare cases have two been noted in a single cell. Cells varied in length from 9 to 30 mm., in the same stem and the width was 3.5 mm., this being the width of the pith. The width of the cells depends on the diameter of the pith as they are never found in the woody part. In one or two cases cells were found which occupied only one half of the diameter of the pith. The cells in side shoots are usually long because the diameters of such shoots are small and those of the pith comparatively smaller. Each cell consists of a cavity in the pith which is plugged at each end with what appears to consist of dark excrement-like material, in layers, closely packed together, each layer being intermixed with threads. The cell is usually but not always lined inside with a thin layer of silk.

The yellowish larvæ in the stems varied considerably in size, some being rather small, but most of them appeared to be full grown or nearly so. Central stems, three and one half high, were found to contain larvæ as follows: 2, 1, 6, 2, 2, 3. Stems from four to five feet high housed the following: 4, 9, 5, 4, 3, 3, 4, 7, 1, 7, 14, 20, 10, 8, 18, 11, 8, 12, 16, 4, 9, 5, 8. In a few instances stems six feet long contained as many as thirty or more.

During April and May the larva spins a rather loose and roomy cocoon which fills a considerable portion of a small cell. After this is completed the larva cuts a circular hole through the wall of the upper part of the cell, usually close to the roof, almost to the outside, leaving only the thin epidermis which is found on the outside of the stem. The large, loose, roomy cocoon connects with this circular hole. After this the larva spins a compact, white, elongate cocoon in which it transforms, this cocoon also connecting at its upper end with the circular opening through the cell wall. These cocoons are usually placed more or less diagonally in the cells and are anchored to the large, loose cocoon by threads. Sometimes, however, the larger cocoon is absent.

Pupation takes place during the last of May and continues until the middle of June and in the central part of the state, the first moths emerged on June 4. In the northern part, however, pupation and emergence take place later. In fact, pupation and emergence take

place during all of June and the first half of July. However, the moths which emerged on July 15 were in all probability stragglers as the majority appeared during June. The first eggs were noted on June 23. Under laboratory conditions these were laid on the upper leaf surfaces and hatched in about one week. In the field they are probably deposited on the stems in addition to the leaves. After hatching the larvæ enter the stem tissue and feed, making longitudinal cavities just under the bark and between the bark and pith. At this time the larva is greenish and except for the head, which is light brown, resembles the tissue in which it feeds. During the last of July and first of August and before they are full grown, they start to excavate the pith and construct a cell. By the time cool weather arrives, all are in their completed, hibernation cells at which time they are of a decidedly yellowish color.

The following parasites of *cloisella* can be noted:

Scambus inquisitoricellus (Dalla Torre). Reared from larvæ feeding externally on *cloisella* larvæ. (Hymen. Conn., p. 321.)

Chelonus laavernæ Ash. Parasitic on *Mompha cloisella* (Smith, Ins. N. J., p. 612). Also bred from *cloisella* larvæ, Riverton, N. J., June 12 (det. R. A. Cushman).

Eurytoma sp. Emerged March 22, New Brunswick, N. J., from cells of *cloisella*. Numerous (det. R. A. Cushman).

Epiurus pterophori Ash. Emerged from cells of *cloisella* collected at New Brunswick and Morristown, N. J. Very abundant. Emerged in laboratory from middle of March to middle of April.

Microbracon sp. from *cloisella* cells (det. Cushman).

Pimpla inquisitor Say. According to Weed in *Insect Life* (Vol. 3, p. 275), the larva of this species is externally parasitic upon *cloisella* larvæ.

At Lakehurst, N. J., on April 4, *cloisella* cells were collected which contained numerous clusters of the mite *Pediculoides ventricosus* N. together with dried larval skins of *cloisella*. Later this mite made its appearance in our breeding cages and killed many of the larvæ. (Mite det. by Dr. Nathan Banks.)

***Mompha stellella* Busck.**

This insect was described by Busck in 1906 (*Canad. Ent.*, Vol. 38, p. 123) from Pennsylvania and District of Columbia specimens and

the larvæ recorded by him as feeding in the bases of the flowers of evening primrose. Winn (Lep. Quebec) states that it occurs at Montreal, Canada, September 10, the food of the larvæ being the seed capsules of evening primrose. It is not recorded by Smith in his "Insects of New Jersey," and this seems strange in view of the fact that we have found this species to be generally distributed over New Jersey, the larvæ living in the flower buds and causing them to swell conspicuously.

Egg.—Length 0.42 mm. Width 0.26 mm. Oval, yellowish-white, translucent, larva showing through transparent chorion which is apparently smooth.

Full Grown Larva.—Length 10 mm. Width 1.7 mm. Elongate, cylindrical, tapering slightly anteriorly and more so posteriorly. Ground color light yellow. All body segments broadly, transversely banded with pink, this band being not so apparent on anterior segments because of it being more diffused. Pink coloration varies considerably and in some specimens is barely visible so that the larva has a light creamy-yellow appearance. Head brown, somewhat mottled and variable in intensity, dark around the margins. Ocelli lateral, six in number, grouped around a dark center. Head and each body segment bears a few minute hairs, some of which are arranged in a more or less transverse row. Head bears several long hairs. Cervical shield brown, covering much of middle portion of dorsal surface of prothorax, front margin straight, posterior margin rounded, divided longitudinally in center.

Pupa.—Length 5.5 mm. Width 1.6 mm. Elliptical, smooth, chestnut-brown.

Adult.—*Mompha stellerella*. Busck's description follows: "Antennæ unicolored, dark brown. Labial palpi whitish ochreous, sprinkled with black scales and with a black annulation just before the tip of terminal joint. Face silvery white. Head and thorax light ochreous, mottled with brown and black scales, costal edge evenly mottled with black and entire apical part of wing sprinkled with sparse black scales, two oblique, ill-defined and indistinct shades of light brown stretch across the wing, one from the base, the other from the middle of costa. There are six tufts of raised ochreous scales in two longitudinal rows, one through the middle of the wing, the other below the fold. The central of the latter tufts which is

found just before the tornus is the largest of them and is terminated by and followed by intense black scales, the most conspicuous marking on the rather evenly mottled wing. Abdomen ochreous. Legs ochreous, mottled with black. Alar expanse 11-12 mm. . . . It is nearest and quite similar to the other *Ænothera* feeder, *Mompha brevivittella* Clemens, but lacks the longitudinal black streaks on the fore-wings and is at once recognized by the black tornal patch."

This species appears when the green flower buds have just started to develop and deposits eggs on them and on the tips of the small leaves surrounding the buds. The larvæ feed on the outside for a short time and then enter the buds. Larvæ were found in buds ranging in size or rather length from 3 to 9 mm. The first feeding inside the bud is near the tip, but the larva soon works downward and feeds on the style and stigma, the stamens and the inner folded parts of the petals. As a result, the bud swells. As development continues, the upper portion of the swollen, closed bud becomes filled with excrement. Sometimes the inner part of the green calyx is eaten out. As a rule, a bud contains only one larva.

When full grown, the larva cuts a small round hole about 1 mm. in diameter in one side of the bud and crawls out, finally dropping to the ground where it constructs an elongate, white cocoon, either on top of or slightly beneath the surface. Particles of soil, etc., are fastened and adhere to the outer surface so that the cocoon is effectively hidden.

Full-grown larvæ can be found in New Jersey during the last half of July and most of August, but during the last of August they become scarce, having left many of the buds by this time. During the last half of August and first part of September, the pupæ are plentiful and the adults issue from the middle of August to the middle of September, a few stragglers even emerging as late as the first few days of October. Part of the brood may overwinter in the cocoons.

On August 27, adults of *Bassus gibbosus* (Say) and *Microbracon mellitor* (Say) (det. R. A. Cushman) were bred from larvæ collected at Riverton, N. J., both being larval parasites of *stella*. On several occasions adults of *M. mellitor* were observed ovipositing in the buds of primrose.

Mompha circumscriptella Zell.

This species was described by Zeller from Texas specimens in 1873 (Verh. Zool.-bot. Ges. Wien., xxiii, 312, 1873). Chambers (Can. Ent., X, 239, 1878) writes of Texas specimens having been received from Miss Murtfeldt, who informed him that the larvæ fed upon the immature seeds of *Cenothera* and pupated within the capsules. Smith (Ins. N. J.) records it from Anglesea, N. J., August 30, rare, the larva in the seed capsules of evening primrose.

The species is really not so rare in New Jersey provided one looks for it. We have found it occurring at New Brunswick, Bound Brook and Egg Harbor. The larva lives in the seed capsules, confining its feeding to the seeds in a few of the compartments and destroying only from one fourth to one third of the seeds in a single capsule.

Egg.—Not observed.

Full Grown Larva.—Length 5.7 mm. Width 1 mm. Subcylindrical; whitish; head dark brown; on either side of front of head is a light band, meeting on apex; ocelli lateral near ventral margin of head, seven, arranged in a ring; each segment beginning laterad of the ventral surface bears a row of fine hairs, equidistant but not in a straight line; on head, first body segment and legs are several fine hairs; in partly grown larvæ last body segment shows a dorsal, dark anal plate which is lighter and hardly apparent in older larvæ.

Pupa.—Length 3.8 mm. Width 1.1 mm. Shape similar to that of other micro-pupæ; reddish-brown with middle portion of abdomen slightly lighter; dorsal surface of anal segment bears two minute tubercles.

Adult.—*Mompha circumscriptella*. Chambers (Can. Ent., X, 239, 1878), in writing of this species, gives the following description and remarks: "I have not seen Prof. Zeller's specimens, but I have received from Miss Murtfeldt specimens which, with the aid of Prof. Zeller's figure and description, I recognize without difficulty as belonging to this species. The thorax, head and palpi are white, except that the basal part of the second joint of the palpi is stained with brownish. The fore wings are of a pale grayish ochreous, with the dorsal margin from the base nearly to the middle snowy white, the white crossing the fold at the base, and further back again crossing the fold and reaching almost to the costal margin; it is

margined behind by two small tufts of raised brown scales, as represented in Zeller's figures, and there is another one on the costa not represented in the figure, which again has a minute brown spot in the white at about the basal fourth, which I do not find in my specimens. The figure also gives a very distinct white streak which leaves the white of the dorsal margin at the fold and curves to the costal margin before the ciliæ; this streak is absent in one of my specimens and much less distinct in the other than it is in the figure. There is a black speck at the hinder angles (indistinct in my specimens) and the apex is dusted indistinctly with brown. Al. ex. $5\frac{1}{2}$ lines."

It is not known just how this species passes the winter nor how early it appears in New Jersey. On August 4, primrose seed capsules collected at Egg Harbor, N. J., which is in the southern part of the state, were found to contain small and medium sized larvæ. These appeared to have entered the seed capsule at its distal end in the depressed part, although from the character of the injury it seemed as if some had entered the base of the capsule close to the stem.

Some capsules contained two larvæ, but one was the rule. In most cases the larva had confined its attention to the immature seeds in only one or two compartments, such compartments being filled with partly eaten seeds and excrement. Upon reaching maturity, which takes place usually during the last three weeks of August, the larva spins a whitish, elongate cocoon within the capsule compartment where it has been feeding, attaching the upper end to the inner side of the outer wall. These cocoons are covered with reddish-brown particles of excrement and are somewhat cigar-shaped. Either after or before spinning the cocoon the larva cuts a circular hole almost to the outside of the capsule. This opening leads to the upper end of the cocoon which is fastened over it and is covered only with a thin film of tissue, which breaks readily and allows the pupa to protrude slightly so as to facilitate the emergence of the adult.

The exit holes are usually found in the upper half of the seed capsules. From material collected in the southern part of the state we secured adults from the seventh to the last of August. It is likely that all of the moths emerge before cool weather because many of the seed capsules split during September and October and allow

the seeds to fall. Numerous seed capsules examined during the winter were found to contain only the empty cocoons and pupal shells. From this it appears that the adults hibernate. In the spring and early summer, no trace of this species was found. Its habits prior to the appearance of the seed capsules are therefore unknown to us. It is quite probable that the first brood develops in the immature flower buds.

A species of *Microbracon*, which Mr. Cushman states requires further study, was bred from the dry seed capsule.

OTHER SPECIES OF MOPPHA ASSOCIATED WITH EVENING PRIMROSE.

Mompha brevivittella Clem.

syn. *anotherivorella* Chambers.

syn. *anotheraseminella* Chambers.

Chambers described this species in 1864 in the genus *Wilsonia* (Proc. Ent. Soc. Phil., II, 428, 1864). Smith (Ins. N. J.) lists it from Lucaston, October 18 (Dke.), and states that the larva lives in the seed capsules of evening primrose, also that the species is probably generally distributed. According to Dyar's Catalogue it occurs in the Atlantic States.

In our work with primrose insects this species was bred from seed capsules collected at Rutherford, Oradell, Tenafly and Springfield, N. J., the adults issuing during the last of August and first part of September.

Mompha murtfeldtella Chambers.

syn. *albocapitella* Cham.

syn. *grissæella*, Cham.

syn. *obscurusella* Cham.

syn. *parvicristatella* Cham.

This was described by Chambers in 1875 (Cinn. Quar. Jn. Sci., Vol. II, p. 237) from a specimen received from Professor Riley and Miss Murtfeldt. In the Canadian Entomologist for 1879, Vol. XI, p. 6, Chambers gives the following information about the habits of this species: "Miss Murtfeldt favors me with the following notes upon the larva of this species: Feeds upon the flowers of *œnotheras* both wild and cultivated and is especially destructive to *O. missouriensis*. Eggs laid singly on sticky surface of calyx and larvæ as soon

as hatched make their way to the center of the bud and feed on petals and stamens. Full grown larva is about one quarter of an inch in length, cylindrical, tapering slightly posteriorly and anteriorly. When young it is of a dull, brownish green color, gradually assuming a reddish tint until at maturity the sides are of a deep dull pink arranged in wavy shaded stripes, which are more intense on the subdorsal spaces. Head oblique, round, pale glossy grayish brown with the dark brown mandibles and the triangular face outlined with the same color. Cervical collar entirely covering top of first segment, of glossy dark grayish brown marked on dorsum with a narrow but distinct longitudinal line of white. Anal plate brown and horny. Legs and prolegs well developed. Pupates in dense, tough yellowish cocoon on the surface of the ground. Moths issue in about ten days. There are at least two distinct broods in a season, the second of which hibernates in cocoons."

We did not find this species in New Jersey and Mr. August Busck suggests that it may not occur this far north.

COLEOPTERA.

Tyloderma foveolata Say.

Of the insects associated with the evening primrose, the weevil *Tyloderma foveolata* Say is one of the commonest and most widely distributed. This species was described by Say in 1831 (Desc. N. A. Curc., p. 19, Lec., ed. I, p. 284), since when its occurrence on the evening primrose has been recorded at various times. Webster briefly mentions (Ins. Life, Vol. 2, p. 11, 1890) the habits of the insect especially in regard to oviposition while Girault (Ent. News, Vol. XXII, p. 112, 1911) gave a further and more detailed account of the insect as he observed it in Illinois. The writers have had it under observation in New Jersey for the past few years and the account here given is a result of their observations as well as those in the papers noted.

The species is widely distributed in the eastern part of the country. Blatchley and Leng (Rlyn. N. E. Amer., 1916) state that it "ranges from New England to Nebraska and south to Florida." Smith (Ins. N. J. St. Mus. Rept., 1909) reports it as occurring throughout New Jersey, May, June, and in our observations we have found it to be more or less common wherever the primrose grows.

It is said to breed in willow herb (*Epilobium* sp.) as well as the

evening primrose although we have no definite records nor have we observed this plant to be infested with it. All of our observations have been made on the evening primrose. The insect hibernates as an adult, both sexes living through the winter, as the beetles have been noted in copulation during the spring and early summer. Blatchley and Leng (*loc. cit.*) state that it hibernates beneath boards and rubbish and Mr. Stafford obtained two specimens while sifting material in the grass along the edge of a peach orchard at Vineland, N. J., March 1.

As soon as the weather becomes sufficiently warm in the spring the insects leave their hibernation quarters and after feeding and mating, the females oviposit. Most of the egg punctures occur on the main stem of the plant, but a number of them may be found on the branches. The number occurring on this latter place depends on the size of the plant and the amount of oviposition. The seed capsules also serve as a place for oviposition at times and even the underside of the leaf petiole is utilized although it is questionable whether any of the eggs located in the latter situation produce adults.

The egg scar consists of an oval area of which the surface tissue at both ends has been pulled back in fine strips and pressed down over the egg which is located in a cavity at the center of the scar. These threads or strips are of a considerable number. They are not drawn back parallel with the stem but some are drawn more or less laterally. Gradually they dry and as fine particles of dirt collect on them, they become dark in color. The scars, especially those located on the lower part of the stem, gradually change their appearance, as the stem grows, becoming more or less rounded; the surface in some cases becomes split above and below and ridged on both sides of the scar and the covering of matted threads becomes loose and falls off.

These scars may vary from 5 to 8 mm. long and from 3 to 8 mm. wide. Measurements of seventeen scars gave an average of 7 mm. long by 5.7 mm. wide. The egg cavity has a diameter of approximately 1.5 mm. The insects has been observed ovipositing on more than one occasion and Girault (*loc. cit.*) has also noted it. The following observation made at Trenton, N. J., June 18, will give an idea of the *modus operandi*.

A female unaccompanied by a male was noted in the act of oviposition on the stem. Part of the egg cavity had been eaten out

when the insect was first observed. The insect was facing upward with its feet well braced and continued the work of excavating the cavity for about five minutes. Having completed this operation, it reversed its position so that the tip of the abdomen fitted in the cavity, spent about a minute in depositing the egg and then again reversed its position and assumed one similar to that which it maintained in making the cavity except that now the cavity was more nearly under the center of its body. Having resumed its position, the beetle reached forward as far as it conveniently could without moving its legs and began tearing minute strips of tissue one after another from the surface, pulling them back over the cavity and contained egg and pressing them down. The first few strips were entirely removed and pushed into the cavity over and about the egg. After continuing in this operation for about ten minutes with the result that a number of the minute strips had been turned back over the egg cavity and a half-oval space marked off above the egg puncture, the beetle again faced about and assuming a like position began tearing up strips from below the egg puncture and folding them back over it. This it continued for thirty minutes with the result that a number of strips had been folded back and the oval completed below the puncture. Then assuming its previous position, it renewed the operation of tearing up and folding back the strips above the egg cavity and continued this for some 25 minutes and finally very briefly pressed down and smoothed over the whole mass. The whole operation thus occupied more than 75 minutes.

As oviposition occurs over a considerable period it results that some plants become pretty well covered with egg scars. As a rule the lowest placed eggs are the earliest laid, while the upper part of the stem is more apt to be free from punctures, but there are exceptions. The following records will give an idea of the amount of infestation. The stems were collected at Trenton, N. J., June 28.

Total Stem Length (in Inches).	Length of Part Bearing Punctures (in Inches).	Number of Punctures.
21	15	44
26	19	70
29	25	82
29	18	25
23	20	44
30	22	44
Averages....26	19	51

Again on July 13, at Trenton, N. J., the following conditions were noted:

Total Stem Length (in Inches).	Length of Part Bearing Punctures (in Inches).	Number of Punctures.
42	32	93
20	13	42
28	22	67
27	23	87
42	32	55
Averages....32	24	68

Other plants were infested as follows:

Length of Plant (in Inches).	Number of Punctures.
27	84
42	55
42	93
44	183
48	152

Girault records one plant as having 267 punctures and another 115.

In the course of a few days the larva hatches from the egg, eats its way in the woody portion toward the pith which it soon enters and there develops. The larva migrates little if any but simply eats out an irregularly oval place in the pith and gradually becomes more or less surrounded with the dark excrement and other material and it is in this chamber that pupation takes place. By late July pupæ may be found in some of the earlier infested stems. Pupation is of short duration and in early August adults may be observed in some infested plants. These are as usual white at first. They gradually darken and soon the adult emerges through a circular exit hole cut through the side of the stem near the pupal chamber. The descriptions of the different stages follow.

Egg.—"Length .80 mm., width .65 mm. Short oval to oval; surface covered with a grayish deciduous substance not unlike a covering of thin sugar and which is opaque and without sculpture. When this is rubbed off, the surface of the egg is polished yellow, with no marked sculpture but slightly coriaceous or like the surface of some leathers. Soft, pliable, easily crushed. Inconspicuous. General color grayish yellow; when seen in natural position the upper side (and also the lower) is slightly flattened. Deposited singly. When ex-

amined with transmitted light the egg is liquid yellow or amber opaque centrally; this color persists until hatching. The pruinose coating is easily removed by gently rolling the eggs between the fingers. The micropyle is not conspicuous" (Girault).

Full-Grown Larva.—Length 7 to 8 mm. Width 2.2 mm. Typical curculio-shaped, creamy white; head small, brownish, mouth parts darker; body strongly convex above, somewhat flattened beneath; skin transversely wrinkled; apodous; hairs on head and body short, sparse; thoracic ambulatory tubercles present.

Pupa.—Length 6.5 mm. Width 2.1 mm. Creamy white; head and thorax bearing a few hairs with pronounced tuberculate bases; dorsal surface of each abdominal segment bears a transverse row of few hairs; tuberculate bases of hairs become larger toward anal segment; body terminated by two parallel spines.

Adult.—*Tyloderma foveolata*. The following is the original description: "Body black, with dilated punctures; head with dense, small punctures, a frontal indentation, and a yellow spot; rostrum robust, moderately arcuated, punctured like the head; antennæ jointed; first joint hardly reaching the eyes; thorax with three small yellowish spots and one before; elytra with regular series of large quadrate punctures; several small yellowish spots and a large, irregular one behind; feet unarmed. Length less than one fifth of an inch."

The adults vary much in size and sculpture, the punctures of the elytra sometimes being in regular rows and again very unevenly distributed.

As has been indicated the development of the insect is very irregular, oviposition beginning in May and continuing well through July, while pupæ were noted in some stems on September 11. The irregularity of development is well shown by the records obtained from some stems examined on June 29, which are as follows: At Woodstown, N. J., 5 small larvæ, 8 medium-sized larvæ, 8 large larvæ, 1 parasitic cocoon were found. At Springfield, N. J., on August 18 the following record was obtained: 4 small larvæ, 2 medium-sized larvæ, 17 large larvæ, 10 pupæ, 5 adults, 5 exit holes from which adults had emerged, 4 parasitic larvæ, 4 parasitic pupæ. It is also worth noting that no apparent injury is done to the primroses by the beetles even when the infestation is severe. Infested plants grow and flower more or less like uninfested ones.

Another interesting point is that there are as a rule many more egg punctures in a stem than will be adults developing from that stem. For example on a stem examined July 29, of 85 egg punctures, over half contained collapsed eggs or nothing. This is due in part to parasitism, but there is also some other factor concerned. Girault has described a species which he bred from the egg of *Tylo-derma foveolata*, known as *Anaphoidea sorditata* Gir. (JOUR. N. Y. ENT. SOC., Vol. XVII, p. 169, 1909). We have obtained this species from eggs collected at Woodstown and several localities in the northern part of New Jersey during June and July.

In addition to the egg parasites there are also several species attacking the larvæ. Pierce (Bul. 73, Bul. 100, U. S. Bur. Ent., 1908, 1912) has recorded several parasites of this species. He states: "It is highly parasitized by *Neocatalaccus tylodermæ*, *Urosigalphus* sp., *Cerambycobius cyaniceps*, *Eurytoma tylodermatis*, *Microbracon mellitor*, and *Sigalphus curculionis*. The four last species are also parasites of the boll weevil. At Trenton, N. J., on September 7, we bred *N. tylodermæ* from stems of primrose infested by *Tyloderma foveolata*."

The parasites infest the larvæ in the burrows. On several occasions we have observed the parasitized larvæ and parasitic cocoons in the burrows as late as November. From these, adults have been secured later. From this it appears that the parasites pass the winter as pupæ in the burrows and emerge the following spring.

Acanthoscelis acephalus Say.

This species has long been known as a frequenter of evening primrose and as a feeder in the axils of the leaves. Hamilton credits it to *Polygonum*, especially *P. hydro Piper*, but it is extremely similar to *Acanthoscelis curtus* which lives on *Polygonum*, there is here a possibility of error. It ranges according to Blatchley and Leng (Rhyn. N. E. Amer.) from Canada and New England to Michigan, Colorado and Kansas south to Georgia. It is frequent throughout Indiana, May 23 to August 2, on evening primrose. Smith (Ins. N. J.) records it as common all along the shore of New Jersey from May to September on the same plant. As a matter of fact it is quite common all over the southern half of the state and occurs more or less abundantly at such inland places as New Brunswick, Riverton,

Princeton, etc. Early in the season the adult appears to prefer feeding in the axils of the leaves, but later it will be found in addition on the developing flower buds and flowers. The larval stage is passed in the developing flower buds.

Egg.—From dissected female. Length 0.65 mm. Width 0.2 mm. Yellowish white or light with slight yellow tinge; glistening; elongate, broadly rounded at both ends, one end slightly narrower than the other.

Full Grown Larva.—Length 6 mm. Width 1.9 mm. Typical curculio-shaped form; creamy white; head reddish-brown, posterior portion of top and sides darker, anterior portion of labrum and mandibles brownish black; dorsal surface strongly convex; ventral surface weakly, concave; head and body bearing several minute hairs; body surface minutely shagreened. Young larva more strongly curved than older one and somewhat lighter in color.

Pupa.—Length 3 mm. Width 2.1 mm. Whitish or creamy white; elytra and wings extend strongly ventrally and posteriorly, the wings extending beyond elytra and approaching each other on the ventral surface. The doubled up femur and tibia of the middle leg extends laterally well over the wing pad and the posterior one extends beneath and beyond. A pair of well separated and prominent, comparatively long spine-like hairs with tuberculate bases is borne between the eyes; anterior to this pair is another pair; anterior margin of prothorax bears a median pair and another pair lateral to it; median dorsal portion of prothorax bears a transverse row of four hairs; a pair of median separated hairs arises toward posterior margin of prothorax and also a pair lateral to these and closer to the posterior margin; between these on the posterior margin is a single hair. Each femoral-tibial joint bears a pair of hairs.

Adult.—*Acanthoscelis acciphalus*. This was described by Say in 1824 (Jour. Acad. Nat. Sci. Phil., IV, p. 309; Lec. ed. II, 173) whose original description follows: "Blackish, spotted with cinereous; thorax with an impressed line, an obtuse tubercle on each side.

"Inhabits the United States.

"Body covered with short robust hairs or scales, brownish-black, spotted and varied with cinereous, imbricate; head, when at rest, completely retracted within the thorax, somewhat retuse between the eyes; thorax anterior margin abruptly contracted into a collar; posterior

edge minutely dentate; an impressed longitudinal line becoming canaliculate towards the scutel; an obsolete, obtuse tubercle each side of the middle; elytra striate; striæ with scales concealing the punctures, interstitial lines with elevated and acute points partially concealed by the scales; tip rounded and piceous on the edge; anal segment black; feet rufous; thighs mutic.

"*Var. a.* A common double abbreviated line at the base of the suture.

"Length more than one tenth of an inch.

"The variety occurs in Pennsylvania. A different species, which I have named *4-spinosus* inhabits this State, remarkable for its similarity to the *acephalus*, but it may be immediately distinguished by the armature of two upright spines on the anterior edge of the thorax. (Belongs *Caliodes*. Lec.)"

In New Jersey the overwintering weevils appear during May and frequent the axils of the leaves where they feed. An examination of the small leaves at this time will show small notches where the tissue was consumed. These notches become intensified as the injured leaves develop. Later in the season when the flower buds are developing, eggs are evidently deposited. As a rule a bud contains only one larva, rarely two. The larva feeds on the immature floral parts until full grown, when it leaves the bud, drops to the soil which it enters to a depth of about one half inch and pupates, this stage requiring about ten or twelve days. Infested buds do not show any outward indication of infestation except perhaps a very slight swelling. Full-grown larvæ appear to be most plentiful from the middle of July on through to the last of August and during the last of August and first week of September adults appear in numbers and feed on the developing heads of the plants, later going into hibernation.

Adults, however, can be found throughout the entire season, part of these undoubtedly being the overwintering ones which persist for a long time, others being those which have developed from the first laid eggs and the remainder being later members and stragglers of this brood. In many instances it was noted that partly or slightly eaten buds opened and the larva would be found attached to the expanded petal. The larva was found to be parasitized by a small hymenopterous larva which we were unsuccessful in breeding to the adult stage.

Haltica marevagans Horn.

This blue flea beetle occurs throughout New Jersey but is most abundant in the southern part. It feeds during both larval and adult stages on the foliage of primroses, skeletonizing the leaves from either the upper or lower surfaces.

Egg.—Length 1.2 mm. Width 0.4 mm. Subcylindrical, obtusely rounded at both ends. Color buff when first laid, becoming darker yellow and finally orange yellow just before hatching. Many eggs streaked lengthwise with a thin line of dark excrement. Outer surface of chorion sculptured with slight subcircular, contiguous depressions with slightly tuberculate elevations between them.

Full Grown Larva.—Length 5.8 mm. Width 1.7 mm. Ground color olive to dark olive, which with dark tubercles cause some larvæ to appear almost black. Subcylindrical, somewhat flattened ventrally, tapering at both ends. Body surface finely shagreened, bearing many tuberculous spots of varying shapes and sizes, some of which bear one and others two bluntly tipped hairs. Antennæ short. Head rounded, lobes moderately constricted posteriorly; front with a median, shallow depression. Color shining black except for a narrow lateral spot including and dorsal to each antenna. Head bearing several hairs on front and sides. Thoracic plate covering dorsal surface of prothorax which bears a single lateral spot. Thoracic plate is of same ground color as other tuberculous spots. Fine median line divides thoracic plate and continues through median, dorsal tuberculous spots of meso- and metathorax. Median dorsal spots of meso- and metathorax similar to those of abdominal segments. Lateral to each of these is a single spot of which the posterior one is much the larger. Below these spots is a longitudinally elongated, spiracular spot and below this a pair of spots. Each abdominal segment beginning with the first bears two transversely elongated, median, dorsal spots placed one behind the other, of which the anterior is the longer. Lateral to each of these on each side are two somewhat more circular spots thus forming two transverse rows of tuberculous spots on the dorsal surface. Below this double row on either side is a tuberculous spot containing the spiracle, below which are two other spots arranged transversely. On the last abdominal segment, the spots are united so as to form single dorsal and ventral spots. On each ventral abdominal segment is an elon-

gated, median, transverse spot posterior and lateral to which is a single spot. Ventral spots of thoracic segments similar to those of abdomen except that the median spot is rounded and that of the prothorax is confluent with the two others forming an irregular one. Outer portions of legs dark brown except for apical portions of femora which are light; inner surfaces lighter. Newly hatched larvæ are somewhat lighter in color than mature ones. The same spots are apparently present but are not clearly defined and appear more confluent.

Pupa.—Length 3.9 mm. Width 1.75 mm. Light yellow. Surface bearing several acutely pointed spine-like hairs arising from minute, darkened tubercles and arranged as follows: Head bears one at base of each antenna; one at outer margin of each eye and one posterior and medianly to this. Prothorax bears a pair on anterior margin on both sides of middle; three on outer angle of lateral margin and a pair of somewhat separated ones on posterior margin near lateral margin; also a median dorsal pair. Meso- and metathorax bear a single one toward lateral margin. Each abdominal segment bears on its posterior margin a transverse, dorsal row of six spine-like hairs (on some segments several of these hairs appear to be missing). Spiracles dorsal, prominent, near lateral margin of each abdominal segment beyond which is a single hair. Extremity of abdomen terminating in a pair of short stout spines. Apices of all femora bear a pair of hairs.

Adult.—*Haltica marevagans*. This was described by Horn in 1889 in his paper, "A Synopsis of the Halticini of Boreal America" (Trans. Amer. Ent. Soc., Vol. XVI, p. 226) and his description follows: "Oval, slightly oblong, moderately convex, deep blue, rarely slightly greenish, shining. Antennæ half as long as the body, obviously thicker externally, piceous, bluish at base, joint four distinctly longer than third and equal to fifth. Head smooth, frontal carina scarcely prominent, the tubercles flat and indistinct. Thorax more than half wider than long, sides arcuately narrowed to the front, margin very narrow, slightly thickened at front angles, disc convex, ante-basal impression extremely indistinct, often obliterated, surface sparsely, finely punctate near the base, an oblique series of coarser punctures beginning at the front angles. Elytra a little wider at base than the thorax, humeri rounded, umbone feeble, a

slight flattening within it, surface finely, but very indistinctly punctate, not closely, smoother near the apex. Body beneath and legs colored as above; abdomen coarsely, not closely punctate. Length 4-4.5 mm.

"The last ventral of the male has a very distinct situation each side, the middle lobe flat, with a deep longitudinal impression extending over half the segment and ending abruptly. In most of the collections examined this species is labelled *foliacea*, from which it differs in form, sculpture and male characters. Occurs along the sea-coast region from Florida to New Jersey, and probably farther north."

In New Jersey the beetles appear during the first part of June and deposit eggs on the leaves of primrose. As a rule these are placed on the lower surface in groups of two or three, although in some few cases as many as twelve were noted in one batch. In a few instances eggs were found on the stems. The eggs are laid on their sides and glued to each other and to the leaf. They hatch in about one week and the larvæ skeletonize the leaves usually from the under surfaces. When full grown they enter the soil in which they pupate, constructing small cells for this purpose about one half inch below the surface.

During the last of July adults appear and eggs are again deposited during the first of August. The second brood of larvæ feed mostly on the leaves but many of those which mature late are found feeding on the small flower buds and even on the green seed capsules. These become full grown about the last of August and then pupate, about two weeks being required for this stage, the hibernating brood of beetles appearing about the middle of September. On account of the overlapping of the two broods adults can be found throughout the state from June through September. In view of the fact that some beetles were found in the pupal cells in the soil during the last half of September, it is quite probable that some overwinter in such places.

Haltica fuscoænea Mels.

This species is another flea beetle which appears to confine its attacks to evening primrose. It occurs in various parts of New Jersey but is especially abundant in the southern part. Its method

of feeding and habits are similar to those of *marevagans* and very often the foliage is completely riddled.

Egg.—Length 0.7 mm. Width 0.21 mm. Except for its smaller size it is similar to the egg of *Haltica marevagans*.

Full Grown Larva.—Length 4.5 mm. Width 1 mm. Somewhat like that of *H. marevagans* in general appearance and number and arrangement of tuberculous spots. However, the following differences are to be noted: the larva is smaller; shagreening is finer; ground color is lighter, being yellowish green; the spots also are of a lighter brown and differ in some cases in outline; the spiracular spot is closer to the two dorsal lateral spots above it and more in between them; when the spot below the spiracular spot is compared with the spiracular spot, a greater difference in size will be found in *fuscoænea* than in *marevagans*; the median line dividing thoracic plates and median thoracic spots is wider in *fuscoænea* than in *marevagans*.

Pupa.—Length 2.8 mm. Width 1.4 mm. Light yellow; smaller than that of *marevagans*; spine-like hairs on head similar to those of *marevagans*; prothorax bears a single spine-like hair on posterior margin instead of a pair as in *marevagans* and a dorsal pair anterior to median, dorsal pair; meso- and metathorax bears a pair of median ones and a single one each side of these; abdominal hairs placed similar to those of *marevagans*; extremity of abdomen terminating in a pair of stout spines which are more elongate than those of *marevagans* and slightly incurved at the tips.

Adult.—*Haltica fuscoænea*. This was described by Melsheimer in 1847 (Proc. Phil. Acad. Nat. Sci., III, 165). The following re-description is by Horn (Trans. Amer. Ent. Soc., Vol. XVI, p. 229): "Oblong oval, moderately shining, olivaceous green, antennæ and legs rufotestaceous. Antennæ a little longer than half the body, joints 2-3-4 gradually increasing in length. Head finely alutaceous, a faint transverse groove between the eyes in which are a few indistinct punctures, frontal carina broad and obtuse, the tubercles small. Thorax transversely subquadrate, very little wider than long, not narrower at apex than base, sides very feebly arcuate, margin very narrow, slightly thickened at the front angles, disc convex, the ante-basal impression fine, but moderately deep, extending nearly from side to side, surface finely alutaceous and with very minute sparse

punctures. Elytra not wider at base than the thorax, humeri broadly rounded, umbone not distinct, surface distinctly sparsely punctate near the base, smoother at apex. Body beneath piceous with æneous luster; abdomen sparsely punctate. Legs rufotestaceous, the posterior femora piceous with æneous surface luster. Length .12-.14 inch; 3-3.5 mm.

"In the male the last ventral is truncate at middle, a slight sinuation on each side, the middle at apex flattened, the edge slightly reflexed. This species has rather the habitus of a *Chetocnema* than *Haltica* in general. The nearly square thorax, together with the pale antennæ and legs will enable it to be distinguished from *polita* and all the others of the genus. Occurs from Massachusetts to Georgia."

In New Jersey it occurs from May to September and according to Smith (Ins. N. J.) it is especially common on evening primrose along the shore. However, we have found it also common as far inland as the Delaware River in the southern part of the state. It is notably scarcer, however, in the northern sections.

In the southern counties it appears during the first week of May and deposits eggs on the foliage of primrose, usually on the lower surfaces. These are placed as a rule in groups of two or three. The eggs are yellow and covered with a whitish envelope which sometimes cracks and falls off. A similar covering is present on the eggs of *marevagans*. The life-history in fact appears to be like that of *marevagans*. About six weeks are necessary for a complete life cycle. Adults appear about the first of May. About the middle of June and again during the first week of August adults appear in numbers. Eggs are again laid at this time and the larvæ when full grown enter the soil and pupate. The evidence at present points to the winter being passed in this stage. During the summer pupation requires about ten days.

OTHER PRIMROSE FEEDERS.

Agallia sanguinolenta Prov.

On July 15 at Lakehurst, N. J., nymphs and adults of this leaf-hopper were observed on evening primrose. It is known as the clover leaf-hopper and usually confines its attacks to clover, alfalfa, cowpeas and vetch. However, it is common in meadow and pasture

lands and feeds on a number of cultivated and native grasses. Its occurrence on primrose at only a single locality in New Jersey probably indicates an accidental infestation due perhaps to the absence of its favorite food plants. This species and its control have been covered by Mr. E. H. Gibson in a recent Farmers' Bulletin (Bul. 737, U. S. D. A.).

Thecodiplosis zauschneriæ Felt.

Rosette galls on the heads of several plants were noted at Monmouth Junction, N. J., on July 10 and imago larvæ presumably of this species were taken from the bases of the leaves of the rosette, eight in one head and five in another. In no other locality were such rosette galls found. *T. zauschneriæ* was described by Felt in 1912 (JOURN. N. Y. ENT. SOC., 20: 146-56).

PLANT LICE.

According to the "Food Plant Catalogue of Aphididæ of World," Part V, by Dr. Edith M. Patch (Me. Ag. Exp. Sta. Bul. 270, 1918) the following species are listed under *Cenothera biennis* L.

Aphis gossypii Glover.

Aphis anotheræ Oestlund.

Myzus biennis Sanborn.

Myzus anotheræ Williams.

Pemphigus anotheræ Williams.

Siphonophora sp. Williams.

In New Jersey we have noted *Aphis anotheræ* Oest. (det. Dr. C. P. Gillette and L. C. Bragg) early in the season in large numbers on primrose leaves and stems. Later in the season *Macrosiphum gauræ* Will. (det. C. P. Gillette and L. C. Bragg) occurred abundantly on the stems and green seed pods. At Riverton, N. J., July 2, *Paragus tibialis* was bred from larvæ feeding on plant lice infesting primrose. A number of lady-bird beetles were noted in connection with aphid infestations and these are treated under the list of Coleoptera.

MISCELLANEOUS SPECIES FOUND ON EVENING PRIMROSES.

Unless otherwise noted the insects named in the following lists were taken on the foliage of evening primrose. The few records from outside sources are followed by the references. It is realized of course that many of the species mentioned have no direct asso-

ciation with the plants and are probably only accidental visitors. Further collecting would add many names to this list.

HOMOPTERA.

Ormenis pruinosa Say.

Palmyra, VII 29, N. J.

Scolops sulcipes Say.

Arlington, VII 25, N. J.

Phlepsius irroratus Say.

Fairlawn, N. J., VII 5.

Scaphoideus immistus Say.

Eatontown, VIII 9, N. J.

HEMIPTERA.

Euschistus variolarius Pal. Beauv.

Tuckerton, N. J., VIII 21.

Thyanta calceata Say.

West Norwood, N. J., VII 24.

Thyrecoris pulicaria Germ.

Springfield, VII 10; Arlington, VII 25, N. J.

Thyrecoris aterrima Mal.

Arlington, N. J., VII 25.

Lygus pratensis L.

Woodbury, N. J.

Ortholomus longiceps Stal.

Fairlawn, VII 25; Monmouth Junction, VII 8; Riverton, Lakehurst, VII 15, N. J. Widely distributed, on primrose.

Jalysus spinosus Say.

Riverton, N. J., August.

Nabis roseipennis Reut.

Fairlawn, N. J., VII 8.

Sinea diadema Fab.

Irvington, N. J., VII 2.

Phymata erosa L.

Arlington, N. J., VII 25.

Triphleps insidiosus Say.

Princeton Jc., VII 2, N. J. Widely distributed on primrose.

Plagiognathus politus Uhl.

Springfield, VII 10; Riverton, VIII 20, N. J.

Resthenia insignis Say.

Lakehurst, N. J., VII 17.

Neurocolpus nubilis Say.

Arlington, N. J., VII 25.

Poeciloscytus basalis Reut.

Lakehurst, N. J., VII 17.

Poeciloscytus lineatus Fab.

Uhlerstown, Pa., VI 11, seriously injuring the foliage.

COLEOPTERA.

Hippodamia convergens Guér.

Woodbury, N. J., VI 30, feeding on plant lice.

Hippodamia glacialis Fabr.

Plainfield, VII 9, N. J.

Coccinella novemnotata Hbst.

Monmouth Jc., N. J., V 30, feeding on plant lice.

Adalia bipunctata L.

Nutley, VII 5, N. J.

Cycloneda sanguinea L.

Lyons, VIII 4; Atlantic Highlands, VIII 15, N. J.

Coccinella 3-fasciata L.

Monmouth Junction, VIII 17, N. J., feeding on plant lice.

Brachyacantha ursina Fabr.

Irvington, N. J., VII 12.

Hyperaspis undulata Say.

Arlington, N. J., VII 25.

Scymnus fraternus Lec.

Woodbury, N. J., VI 30.

Lebia viridis Say.

Riverton, VIII 20; Eatontown, VII 5; Lakhurst, VII 25, N. J.

Scirtes tibialis Guér.

Monmouth Junction, N. J., VII 15.

Pyropyga decipiens Harr.

Plainfield, N. J., VII 9.

Chauliognathus marginatus Fabr.

Plainfield, N. J., VII 9.

Podabrus rugulosus Lec.

Monmouth Junction, N. J., V 30.

Lachnosterna lanceolata Say.

Feeding on evening primrose (W. P. Hayes) (Jour. Econ. Ent., Vol. 12, p. 115).

Anomala lucicola Fab.

Woodbury, N. J., VI 30; Uhlerstown, Pa., VI 11, plentiful at latter locality and injuring foliage considerably.

Popilia japonica Newm.

Riverton, N. J., August, feeding on foliage.

Lema 3-lineata Oliv.

Monmouth Junction, N. J., V 30; this is the old-fashioned potato beetle.

Graphops marcassitus Cr.

Trenton, V 26; Rutherford, VIII 19, N. J.

Graphops pubescens Mels.

Common throughout New Jersey, May to September on foliage of evening primrose. This is one of the strawberry root borers. Smith (Ins. N. J.) states "at roots of evening primrose" (CH.), but we were unable to locate it there in any stage, although it was plentiful on the foliage and buds.

Colaspis brunnea Fab.

Uhlerstown, Pa., VII 8.

Plagioderia versicolor Laich.

New Brunswick, N. J., VI 30, on primrose near willow.

Diabrotica 12-punctata Oliv.

Tuckerton, N. J., VIII 21.

Galerucella nymphaea L.

Monmouth Junction, VII-7, on primrose near water.

Epitrix cucumeris Harr.

VI 10; Woodbury, VI 30; Princeton, VI 20, N. J. Feeding on foliage of primroses near potato fields.

Haltica exapta.

On evening primrose. (Ins. Life, Vol. 3, p. 26.)

Haltica ignita Ill.

Atlantic Highlands, N. J., VIII 25. The strawberry flea beetle. According to Chittenden (U. S. Bur. Ent. Bul. 23, pp. 70-78) the beetle also deposits eggs on the leaves of primrose and related plants and the larvæ feed on the leaves and seed pods (Schwarz). We have not found this species breeding on primrose in New Jersey, but

have found *H. fuscoænea*, a related species resembling *ignita*, very abundant in places.

Chætocnema denticulata Ill.

Springfield, N. J., VIII 12.

Systema hudsonias Forst.

Trenton, N. J., V-18.

Rhipiphorus dimidiatus Fabr.

Palmyra, N. J., VII 29.

Phyllotreta sinuata Steph.

Monmouth Junction, N. J., VI 10, feeding on foliage.

Coptocyclus bicolor Fab.

Trenton, V 26, N. J.

Mordella 8-punctata Fabr.

Monmouth Junction, N. J., VII 18.

Auleutes ater Lec.

Monmouth Junction, N. J., VI 10, feeding at bases of young leaves.

Otiorhynchus ovatus L. Trenton, N. J., VI 26. The larva of this species is the strawberry crown-girdler.

Sitones hispidula Germ.

Woodbury, N. J., VIII 21.

Gymnetron teter Fab.

Monmouth Junction, N. J., VI 10, feeding in heads and in axils of leaves.

Chalcodermus collaris Horn.

Occurs on evening primrose in Illinois (Hart). (Rbyn. N. E. Amer.)

Tyloderma ærea Say.

Trenton, N. J., V 26; Hackensack, November, in rosettes.

Acanthoscelis curtus Gyll.

Monmouth Junction, N. J., VI 10, feeding at bases of young leaves.

Cœlogaster zimmermanni Gyll.?

Uhlerstown, Pa., VI 11.

Madarellus undulatus Say.

Woodbury, N. J., VIII 21.

Mecopeltus scandens Dietz.

Anglesea, N. J., VII 12 (W.) (Ins. N. J.). Occurs on primrose (Robinson) (Rbyn. N. E. Amer.).

LEPIDOPTERA.

Eupithecia interruptofasciata Pack.

New Brunswick, N. J., August 23, bred from larva found feeding on foliage (det. W. Schaus).

Sparganothis sulfureana Clem.

Riverton, N. J., September 19, bred from larva feeding on primrose.

HYMENOPTERA.

Monostegia martini MacG.

Larva feeds on *Aethiops* (Bul. 22, Conn. Geol. Nat. His. Sur. Hymen. Conn., p. 47).

Inastemma sp.

West Norwood, N. J., VII 24, taken on head of evening primrose (det. A. B. Gahan).

Monomorium minimum Emery.

Riverton, N. J., July 29, in flower buds which had been partly eaten out by other insects.

Cremastogaster lineolata Say.

Egg Harbor, N. J., August 3.

Myrmica scabrinodis Nylander.

Arlington, N. J., VII 25.

Leptothorax curvispinosus Mayr.

Trenton, N. J., VII 1, in primrose stem. Arlington, N. J., VII 25.

Tetramorium cæspitum L.

Monmouth Junction, N. J., V 30.

Tapinoma sessile Say.

West Norwood, N. J., VII 24.

Prenolepis imparis Say.

Eatontown, N. J., VIII 29; Atlantic High., VIII 15, N. J.

Formica fusca Linné var. **subsericea** Say.¹

Fairlawn, VII 5; Monmouth Junction, V 30, N. J.

Formica pallide-fulva var. **fuscata** Emery.

Atlantic Highlands, N. J., VIII 16.

Nysson plagiatus Cress.

Eatontown, N. J., VIII 29. In flowers.

Halictus cressonii Rob.

Lakehurst, N. J., VII 17, in flower.

¹ Identified by Dr. Wheeler.

Halictus ligatus Say.

Monmouth Junction, N. J., VIII 7, in flower.

Halictus sparsus Rob.

Atlantic Highlands, N. J., VIII 15, in flower.

Halictus illinoisensis Rob.

Tuckerton, N. J., VIII 21, in flowers.

Halictus pilosus Cress.

Tuckerton, N. J., VIII 21, in flowers.

Agapostemon virescens Fab.

Monmouth Junction, N. J., VII 7, in flowers.

Melissodes dentiventris Smith.

Monmouth Junction, N. J., VII 7, in flower.

Prosopis cressoni Ck.

Caldwell, N. J., VII 28, bred from cell in dry primrose stem.

Stelis lateralis Cress.

Trenton, N. J., V 18, in flowers.

Bombus impatiens Harris.

Tuckerton, N. J., VIII-20 in flowers.

DIPTERA.

Paragus angustifrons Loew.

Red Bank, N. J., September 1, emerged from puparium on primrose stem (det. C. T. Greene).

Sphærophoria cylindrica Say.

Irvington, N. J., August 5, bred from larva feeding on plant lice on primrose (det. C. T. Greene).

Eristalis tenax Linn.

Observed in various parts of New Jersey visiting flowers during the fall.

STATISTICS OF PRIMROSE INSECTS.

	Feeders on or in During One or More Stages.	Flower Visitors.	Found on Foli- age or Stems.	Totals.
Homoptera.....	8		4	12
Hemiptera.....	1		15	16
Coleoptera.....	13		32	45
Lepidoptera.....	13	1 ²		13
Hymenoptera ¹	1	10	9	20
Diptera ²	1	1	2	4
Totals.....	37	11	62	110

¹ Parasites not included.

² Also a feeder.

ACKNOWLEDGMENTS

We are greatly indebted to the following persons for help in the preparation of this paper: to Mr. C. W. Leng for references to the literature of the Coleoptera and identifications in this order, to Mr. C. A. Frost for determinations in the Coleoptera, to Mr. H. G. Barber for identifying the Hemiptera, to Mr. M. R. Smith for determining the ants, to Mr. August Busck and Mr. Carl Heinrich for their help with the micros and other Lepidoptera, to Dr. C. P. Gillette and Mr. L. C. Bragg in connection with the plant lice, to Dr. J. Bequaert in connection with the Hymenoptera except the parasites, and to the specialists named in the text who through the courtesy of Dr. L. O. Howard identified the dipterous and hymenopterous parasites. The photographs were taken by Mr. Erdman West, to whom we are also grateful for many miscellaneous observations on primrose insects.

EXPLANATION OF PLATES I, II AND III.

- A. Adult, *Celerio lineata*.
- B. Larva of *Celerio lineata*.
- C. Adult, *Rhodophora florida*.
- D. Adult, *Apantesis arge*.
- E. Adult, *Euthisanotia unio*.
- F. Adult, *Desmia funeralis* (after Strauss).
- G. Primrose stem split lengthwise showing winter cells of *Mompha eloisella* larvæ. Third cell from top shows the silken lining.
- H. Enlarged view of I.
- I. Single larval cell of *Mompha eloisella*.
- J, K. Primrose stem split showing larvæ and larval cavities of *Tyloderma foveolata*.
- L. Adult, *Mompha eloisella*.
- M, N. Primrose leaves showing feeding of *Haltica marecagans* and *Haltica fuscoanea* larvæ and adults.
- O. Swollen primrose flower bud infested by the larva of *Mompha stellella*.
- P. Folded primrose leaf containing pupa of *Desmia funeralis*.
- Q, R. Primrose flower buds in different stages of development.
- S. Seed capsule of evening primrose in different stages of development.

- T, U.* Dry seed capsules showing exit holes of *Mompha circumscriptella* and *Mompha brevivittella*.
- V.* Primrose stem during the winter showing the dry, open seed capsules.

STUDIES IN RHYNCHOPHORA. IX. THE SEXES OF CONOTRACHELUS BREVISETIS CHAMP.

BY D. SHARP,

BROCKENHURST, ENGLAND.

The species was described by Champion (Biol. Centr. Amer., 4, pt. IV, p. 402, pl. 20, figs. 14, 14*a*, *b*, and *c*), who recognized it as occurring in Guatemala, Panama and Venezuela. I have recently received a series from French Guiana which are apparently this species; Mr. Champion after comparison of a pair of the Guiana examples has decided that they are the same as the Central American form. The species is remarkable externally on account of the last dorsal being unusually extended forwards on the venter, as described by Champion, "in the male the pygidium exposed and becoming ventral." This character induced me to dissect some of my specimens, as I have found that unusual shape of the last body-segment in the male is usually accompanied by peculiar conformation of the internal sexual apparatus. And on making dissection I found so strange a structure that I forwarded specimens to Mr. F. Muir in Honolulu. He and Mrs. Muir examined them carefully, and were so good as to make drawings, which are reproduced on the plate accompanying this paper.

The male, figures 2 to 6, has the apex of the median lobe deflexed so that it is at right angles with the body of the lobe, the struts *ms.* are very short. The tegmen, *tg.*, is a ring, without strut, but the sides of the ring are prolonged as two delicate superior appendages, *tgt.*, the dorsum of the ring has only a very slender connection with the side (fig. 3 shows this angle rather too robust). The body, *ml.*, of the median lobe shows a depression, *mo.*, commencing before the deflexed apex and continued for some distance on the deflexed